

# TERTIARY FOSSIL PLANTS FROM THE REPUBLIC OF HAITI.

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The romantic island of Haiti or Hispaniola, which next to Cuba is the largest of the Antilles, is divided politically into the Dominican Republic and the Republic of Haiti. At the invitation of the respective Governments the United States Geological Survey has, in the last few years, made geologic studies of the island under the direction of T. Wayland Vaughan. Geologic and paleozoologic data of great importance have been obtained, and a few collections of fossil plants were also secured. Those from the Dominican Republic, comprising small and for the most part poorly preserved materials of Tertiary age, were described by me in a recent paper.<sup>1</sup>

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The work in the Republic of Haiti, in charge of W. P. Woodring, resulted in 13 small collections of fossil plants at the following localities:

B 320 F. Département du Nord, 7 km. north of Dondon on trail to Grande Rivière, altitude about 400 meters above sea level. J. S. Brown, collector. March 21, 1921.

B 91 F. Département du Sud, bluff on left bank of Bras à Gauche de Grande Rivière de Jérémie, about 10 km. south of junction of Bras à Gauche with Bras à Droit, and 5 km. north of Sources Chaudes de Dame Marie. J. S. Brown, collector. November 17, 1920.

B 272 F. Département du Nord, about 6 km. south by west of Plaisance on road to Ennery, north slope of Mt. Puilboreau, altitude about 550 meters above sea level. J. S. Brown, collector. February 25, 1921.

W 190 F (U. S. G. S. Tertiary invertebrate station 9907).<sup>2</sup> Département de l'Ouest, first high bluff on left bank of Rivière l'Ayaye above junction with Rivière Artibonite, about 18 km. northwest of Las Cahobas. W. P. Woodring, collector. January 10, 1921.

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<sup>1</sup> Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, pp. 117-127, pl. 21, 1921.

<sup>2</sup> Some of the localities have station numbers in the United States Geological Survey catalogue of Tertiary invertebrate fossil localities, as invertebrate fossils were collected at the same locality and from the same beds.

B 58 F. Département du Sud, La Ravine du Sud at intake on Canal d'Avezac, 2 km. north of Camp Perrin. In part from bluff about 100 meters southwest of intake, collected by W. S. Burbank, November 5, 1920; in part from locality 60 meters northeast of intake, collected by J. S. Brown, November 6, 1920.

B 88 F (U. S. G. S. Tertiary invertebrate station 9544). Département du Sud, valley of Bras à Droit de Grande Rivière de Jérémie, about 1 km. east of Chambellan Market on trail to Jérémie. J. S. Brown, collector. November 16, 1920.

B 311 F. Département du Nord, bed of ravine just west of road from Fort Liberté to Acul Samedi, about 5 km. northeast of Acul Samedi. J. S. Brown, collector. March 18, 1921.

B 95 F (U. S. G. S. fossil plant station 7541). Département du Sud, valley of Grande Rivière de Jérémie, on trail between Maïron and Fondelet Markets, about 12 km. southwest of Jérémie. J. S. Brown, collector. November 18, 1920.

W 233 F (U. S. G. S. Tertiary invertebrate station 9927). Département du Nord, north limb of Thomonde anticline, on trail from Thomonde to Hinche, about 4.5 km. north-northwest of Thomonde, altitude 350 meters above sea level. W. P. Woodring, collector. January 26, 1921.

B 139 F (U. S. G. S. fossil plant station 7542). Département de l'Ouest, trail from La Chapelle to Mirebalais, from ravine 1 km. west of highest locality on trail, about 10 km. southeast of La Chapelle, altitude about 300 meters above sea level. J. S. Brown, collector. December 18, 1920.

K 210 F (U. S. G. S. fossil plant station 7543). Département de l'Artibonite, ravine above highway bridge on road from St. Marc to Gonaïves, about 4 km. northeast of St. Marc. W. S. Burbank, collector. March 30, 1921.

W 185 F (U. S. G. S. fossil plant station 7544). Département de l'Ouest, cut along road from Mirebalais to Las Cahobas, on north side of ravine at foot of mountain on north side of gap. W. P. Woodring, collector. January 8, 1921.

W 96 F (U. S. G. S. fossil plant station 7555). Département du Sud, Vallée de l'Asile, south side of Rivière Serpent between Source Paul and Source Goudet. W. P. Woodring, collector. November 16, 1920.

Locality B 320 F, tentatively referred to the Cretaceous, furnished much broken fragments of linear leaves or small stems that are not determinable. Localities B 91 F and B 272 F, referred to the Eocene, yielded only small fragments, none of which are determinable. Locality W 190 F, referred to the Miocene, furnished undeterminable lignified stems. Localities B 58 F and B 88 F, referred to the Miocene, furnished respectively lignified stems and leaf fragments, none of which are determinable. Locality B 311 F, referred tentatively to the Pleistocene, furnished fragments of leaves, none of which are determinable. Locality B 95 F (station 7541) furnished the Dominican species *Guet-tarda cookei* Berry, undeterminable dicotyledonous fragments, and the *Gymnogramme* which occurs at two other localities. Locality W 233 F furnished fragments of dicotyledonous leaves, probably representing the genus *Ficus*. Localities B 139 F (station 7542) and K 210 F (station 7543) furnished one or two determinable species. Locality W 185 F (station 7544), from which the only considerable collection was made, furnished several identifiable forms. Locality W 96 F (station 7555) furnished *Chara* fruits from locustrine beds of Miocene age.

The locality W 185 F, which is considered of middle or upper Miocene age, contains the same *Gymnogramme* found at two other localities which are also referred to the Miocene. In the absence of clearly defined stratigraphic evidence I would be inclined to consider all three localities as of the same age. Although the present collections are not conclusive, I would be inclined to regard the few Miocene plants collected as pointing to late, rather than early Miocene age.

In addition to the few species named and described in the following pages the Miocene beds at station 7544 contain several fragments of what appear to be a species of *Terminalia*, a palm ray, and fragments of six or eight species of dicotyledons which might be readily determinable if a described fossil flora was known from this general area and horizon. The collection from station 7542 contains fragments of lauraceous leaves suggesting the genus *Nectandra*, and a second distinctly lauraceous type is present at locality B 88 F.

The flora described is too small to be of any especial significance. It is, perhaps, superfluous to point to its modern facies and tropical character. The nine species described, of which all but two are new, represent as many genera, seven families, and as many orders. A large number of forms that might reasonably be expected from the late Tertiary of this region are conspicuously absent, notably Leguminosae and members of the mangrove association. This appears to mean two things, namely, the absence of tidal mud flats and river estuaries, and suggests sandy or rocky shores. All of the leaves enumerated are of strand plants and all are maceration resisting forms, indicating that the other normal members of the Tertiary strand flora failed of preservation, at least at the discovered localities.

### Family CHARACEAE.

#### Genus CHARA Linnaeus.

##### CHARA WOODRINGI, new species.

This species is represented by numerous calcareous and very fragile oogonia. Oogonium circular in cross section; elliptical in profile, slightly fuller distad than proximad; almost twice as long as wide; somewhat variable in size, which ranges from 0.5 to 0.8 millimeter in diameter, and from 0.75 to 1.25 millimeters in length. Proximal pole with a thin pentagonal calcareous plug which is frequently broken away. Apical pole consisting of the tips of the five cells which are enlarged and slightly thickened. The five cells of the wall make three revolutions, the spirals are hence low, and are roundly furrowed between the knife-edge extended keels of the cell margins.

These remains were found in association with a small fresh-water fauna at an altitude of 160 meters at the locality cited below. The species is described as new and named for the collector. It is possible that it may be the same as a still existing species, but as practically no systematic work has been done on the American Charas since the death of T. F. Allen, and I do not have adequate material of recent species for comparison, no other method of treatment is possible.

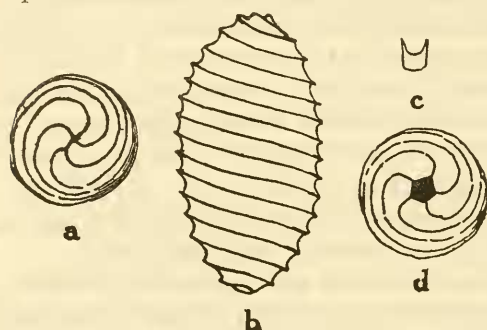


FIG. 1.—OOGONIUM OF CHARA WOODRINGI: a, APICAL VIEW; b, PROFILE VIEW; c, CROSS SECTION OF A SINGLE CELL, ALL GREATLY ENLARGED; d, BASAL VIEW.

Although a few species have been described, practically nothing has been done on the fossil Charas of America, although they are known to be abundant at certain horizons, and their abundance when present in a deposit, their wide geographical range and minute but clearly differentiated specific expression tend to make them excellent horizon markers as Reid and Groves<sup>3</sup> have lately shown in an account of the Eocene forms from southern England.

*Occurrence.*—Miocene (station 7555).

## Class LEPTOSPORANGIATAE.

### Order POLYPODIALES.

#### Family POLYPODIACEAE.

##### Genus GYMNOGRAMME (of authors).

##### GYMNOGRAMME WOODRINGI, new species.

Plate 1, figs. 1-4.

In absence of more perfect and fertile material it is impossible to be sure of the generic position of this fern and I have therefore referred it to the genus *Gymnogramme* of Hooker and Baker with the clear recognition that this genus is a composite.<sup>4</sup> This type of sterile pinnule has been referred to *Acrostichum*, *Lomariopsis*, *Blechnum*, etc. The species is named for the collector, Dr. W. P. Woodring. The frond appears to have been pinnate and of few pinnules. The pinnules are lanceolate or ovate-lanceolate in form,

<sup>3</sup> Reid, C., and Groves, J., Quart. Journ. Geol. Soc. Lond., vol. 77, pp. 175-192, 1921.

<sup>4</sup> On this point see Underwood, L. M., Torrey Bot. Club Bull., vol. 29, pp. 617-634, 1902, and the subsequent systematic publications of W. R. Maxon.

with acuminate apex and base. The midvein is stout and prominent, expanded proximad to form a knoblike, subsessile base. Lateral veins numerous, closely spaced, parallel, diverging from the midvein at wide angles and pursuing straight courses to the margins, pre-vaillingly simple, although a single instance of a basal dichotomy was observed.

Fragments of this fern are rather common and occur in the collections from three different localities. There are 15 specimens from station 7544, 9 specimens from station 7542, and a single specimen from station 7541. Except for the simple veins and entire margins this form is much like *Blechnum betijoquensis* Berry<sup>5</sup> of the Miocene of Venezuela, and it may be a species of *Blechnum*, some species of which have simple lateral viens. All of the localities from which the present species is recorded have been referred to the Miocene.

*Occurrence*.—Artibonite group, Miocene (stations 7544, 7542); Miocene (station 7541).

*Cotypes*.—Cat. Nos. 36606–36609, U.S.N.M.

## Class DICOTYLEDONAE.

### Order CHENOPODIALES.

#### Family NYCTAGINACEAE.

##### Genus PISONIA Linnaeus.

##### PISONIA CONDITI Berry.

Plate 1, fig. 5.

*Pisonia conditi* BERRY, Proc. U. S. Nat. Mus., vol. 59, p. 119, pl. 21, fig. 1, 1921.

This species was described by me as follows: Leaves of small size, lanceolate, and slightly inequilateral in general outline, widest in the middle and equally pointed at the apex and base. Margins entire. Texture coriaceous. Length about 3.25 cm. Maximum width about 1.1 cm. Petiole very short and stout, only a millimeter or two in length. Midrib stout and prominent. Secondaries thin, immersed; five or six alternate camptodrome pairs diverge from the midrib at angles of about 45 degrees. These small leaves are characteristically inequilateral by having the basal margin flat on one side and curved on the other, with the distal margin flat on the opposite side and curved on the other side.

This species was based upon material of Tertiary (Miocene or Pliocene) age, collected at Sánchez, Dominican Republic. What appears

<sup>5</sup> Berry, E. W., Proc. U. S. Nat. Museum, vol. 59, p. 559, pl. 107, fig. 1, 1921.



to be identical with it is also present in the Republic of Haiti. The latter material shows a leaf slightly narrower than the type, but otherwise identical with it in both form and venation.

The genus *Pisonia* contains over a dozen fossil species ranging from the Upper Cretaceous through the Tertiary, in the Northern Hemisphere. In the United States there are three species in the Wilcox, one in the Claiborne and three in the Jackson Eocene, and an eighth in the Alum Bluff formation (Miocene). None of these are especially close to the present fossil. The existing species are numerous, chiefly tropical and in the Western Hemisphere. The genus is still present in the floras of both the Island Republics.

*Occurrence*.—Artibonite group, Miocene (station 7543). (Cat. No. 36610, U.S.N.M.)

## Order GERANIALES.

### Family SIMARUBACEAE.

#### Genus *SIMARUBA* Aublet.

#### *SIMARUBA HAITENSIS*, new species.

Plate 1, fig. 8.

Leaves pinnately compound, as suggested by their botanical relations, and by the sessile or subsessile, inequilateral, falcate character of the material. Leaflets ovate or elliptical in outline, widest in the median region, narrowed distad, and either rounded or shortly pointed. Base widely rounded and apparently sessile. The scanty amount of material (3 specimens) all lacks tips, so that the character of the apex is uncertain—one specimen suggests that it was emarginate, and the more complete specimen figured suggests that it may have been short pointed, although there is room in this specimen for it to have been rounded or emarginate. Margins full and entire. Texture subcoriaceous. Length about 3.5 cm. Maximum width about 1.75 cm. Midrib relatively very stout and prominent, curved. Secondaries numerous, stout, diverging from the midrib at wide angles, and camptodrome in the marginal region.

The genus *Simaruba*, which in the modern flora has a limited number of species confined to the equatorial region of the Western Hemisphere has a fossil species in the lower Eocene of the Mississippi embayment<sup>6</sup> and a second in the Miocene of Venezuela.<sup>7</sup>

*Occurrence*.—Artibonite group, Miocene (station 7544). A not certainly determined fragment from station 7542 appears to represent this species.

*Holotype*.—Cat. No. 36611, U.S.N.M.

<sup>6</sup>Berry, E. W., U. S. Geol. Survey Prof. Paper 91, p. 252, pl. 54, fig. 7, 1916.

<sup>7</sup>Berry, E. W., Proc. U. S. Nat. Mus., vol. 59, p. 573, pl. 109, fig. 2, 1921.

## Order THYMELEALES.

## Family LAURACEAE.

## Genus MESPILODAPHNE Nees.

## MESPILODAPHNE HISPANIOLANA, new species.

Plate 1, fig. 11.

Leaves of medium size, about 9 cm. in length by 3 cm. in maximum width. Widest at or slightly below the middle, tapering upward to the acuminate tip, and downward to the cuneate base. Ovate-lanceolate in general outline, and presumably with a short petiole, margins entire, somewhat, but very slightly undulate. Texture subcoriaceous. Midrib stout. Secondaries relatively thin, ascending, camptodrome; 4 or 5 irregularly spaced and not subparallel pairs diverge from the midrib at angles of 45 degrees or less, some curve upward with a single camptodrome arch, others are more ascending with several diminishing arches along the margins of the leaf. The tertiaries are prominent and typically lauraceous, forming polygonal meshes, passing imperceptibly into a similar areolation, not shown in the figure, but exactly like that shown in the accompanying text figure of the existing *Mespilodaphne glauca*, except that in the fossil it is on a smaller scale.

Many fragments of these leaves in the collection show this areolation with great distinctness, but it is impossible to correctly depict it in a pen drawing. It is so characteristic that pieces of the leaf one-half an inch square are readily and positively identified. The present species, clearly distinct from previously described forms, represents a well defined type, appearing in the geological record at least as early as the lower Eocene in southeastern North America, and continuing down to the present, there being a large number of existing species of *Mespilodaphne* in the American tropics. The existing form most like the fossil is *Mespilodaphne glauca* of northern South America, and I have introduced an auto-print of a leaf of this species for comparison with the fossil and also to show the areolation that is such a clear-cut feature in the fossil form.

*Occurrence*.—Artibonite group, Miocene (station 7544).

*Holotype*.—Cat. No. 36612, U.S.N.M.

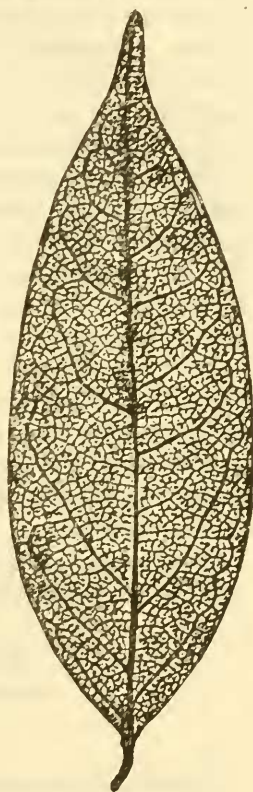


FIG. 2.—NATURE PRINT OF A LEAF OF MESPILODAPHNE GLAUCA FOR COMPARISON WITH THE FOSSIL.

## Order EBENALES.

## Family SAPOTACEAE.

Genus *MIMUSOPS* Linnaeus.*MIMUSOPS PRAEPARVIFOLIA*, new species.

Plate 1, fig. 10.

Leaves elliptical in outline, about equally rounded at the apex and base, with full, entire margins. Texture coriaceous. Length about 4.5 cm. Maximum width about 2.75 cm. Petiole missing. Midrib stout and prominent. Secondaries numerous, about 10 pairs, diverging from the midrib at wide angles, camptodrome, largely immersed in the leaf substance. Tertiaries obsolete by immersion.

These leaves present obvious features allying them with the genus *Mimusops*, and represent a type that makes its appearance in the geological record in the lower Eocene of Southeastern North America, and continues down to the present when it is represented by about 40 species, found in the strand flora of the tropics and subtropics of both hemispheres.

The present fossil species is very close to the existing *Mimusops sieberi* A. DeCandolle of the Antilles, being somewhat wider and less elongate, but of the same general type. I have recognized this resemblance in the specific name chosen for the fossil, which is based on the Nuttallian name *parvifolia* which was formerly applied to this existing species.

*Occurrence*.—Artibonite group, Miocene (station 7544).

*Holotype*.—Cat. No. 36613, U.S.N.M.

Genus *CHRYSOPHYLLUM* Linnaeus.*CHRYSOPHYLLUM CAHOBASENSIS*, new species.

Plate 1, fig. 9.

Leaves ovate-lanceolate in outline, widest at or slightly below the middle, and tapering upward to the acuminate tip and downward to the rounded-cuneate base. Margin entire. Texture coriaceous. Length about 6 cm. Maximum width about 2.5 cm. Petiole missing. Midrib stout, curved, prominent on the lower surface of the leaf. Secondaries stout, more or less immersed in the leaf substance, numerous, and subparallel, diverging from the midrib at wide angles, and abruptly camptodrome in the marginal region. Tertiaries mostly immersed in the leaf substance, a few transversely elongated ones are visible, as shown in the accompanying figure. Lower surface of the leaf covered with tiny dots which are interpreted as indicating pubescence in life.



This well-marked new species presents all of the essential features of the genus *Chrysophyllum*, and foreshadows the existing *Chrysophyllum oliviforme* Lamarck, of the Florida Keys and Antilles. The genus, which is confined to the tropical and subtropical regions of the world, is mostly American, and has been present in equatorial America since lower Eocene time.

*Occurrence*.—Artibonite group, Miocene (station 7544).

*Holotype*.—Cat. No. 36614. U.S.N.M.

### Genus BUMELIA Swartz.

#### BUMELIA CUNEATAFOLIA, new species.

Plate 1, figs. 6, 7.

Leaves of small size, obovate and somewhat inequilateral in general outline, widest above the middle. Apex bluntly pointed. Base cuneate. Margins full and entire. Texture subcoriaceous. Length about 3.5 cm. Maximum width about 1.4 cm. Petiole short and stout, about 3 mm. in length. Midrib relatively stout, curved. Secondaries thin, diverging from the midrib at angles of about 45 degrees, camptodrome. Tertiaries as indicated in the accompanying enlarged figure.

This new species suggests comparisons with the somewhat larger existing *Bumelia angustifolia* Nuttall, of the Gulf coastal region of the United States, and *Bumelia cuneata* Swartz, of the Florida Keys and Antilles, the resemblance to the latter furnishing the specific name proposed for the fossil. The genus *Bumelia* has been present in southeastern North America since lower Eocene time, or earlier, and its score or more existing species are now confined to the warmer temperate and tropical parts of the Western Hemisphere.

*Occurrence*.—Artibonite group, Miocene (station 7544).

*Holotype*.—Cat. No. 36615, U.S.N.M.

## Order RUBIALES.

### Family RUBIACEAE.

#### Genus GUETTARDA Endlicher.

##### GUETTARDA COOKEI Berry.

*Guetardat cookei* BERRY, Proc. U. S. Nat. Mus., vol. 59, p. 125, pl. 21, figs. 5, 6, 1921.

Fragmentary material from the Republic of Haiti is almost certainly this species which was described recently from the Miocene of the Dominican Republic. More recently, in studying Miocene plants from the Isthmus of Tehuantepec, a similar species of *Guet-*

*tarda* which I have tentatively identified as this species was discovered. This suggests Miocene land connection between Haiti and Central America, and emphasizes the importance of additional collections of plants from both of these areas in an attempt to confirm this suggestion.

*Occurrence*.—Miocene (station 7541.)

#### EXPLANATION OF PLATE 1.

FIGS. 1-4. *Gymnogramme woodringi*, new species.

Fig. 1. Station 7542.

Figs. 2-4. Station 7544.

5. *Pisonia conditi*. Station 7543.

6, 7. *Bumelia cuneatofolia*, new species. Station 7544.

Fig. 7. Enlarged to show venation.

8. *Simaruba haitensis*, new species. Station 7544.

9. *Chrysophyllum cahobasensis*, new species. Station 7544.

10. *Mimusops praeparvifolia*, new species. Station 7544.

11. *Mespilodaphne hispaniolana*, new species. Station 7544.